Claims

1. A wide area electron beam device comprising,

a chamber having a partially evacuated interior enclosed by walls, including first and second end walls and a side wall structure;

a semiconductor slice high voltage cathode near the first end wall of the chamber;

a conductive plate anode near the second end wall of the chamber;

first and second spaced apart wire mesh electrodes defining a spatial volume in relation to the chamber side wall structure,

a neutral ion plasma generated within the spatial volume between the first and second wire mesh electrodes, the ion plasma supplying ions to the cathode through one of the first and second wire mesh electrodes, the ions impinging on the cathode causing secondary electron emission having sufficient energy to traverse through the ion plasma toward the anode, thereby forming an electron beam extending over the anode.

2. The electron beam device of claim 1 wherein the semiconductor slice cathode is treated to have a uniform emission of electrons over the surface.

3. The electron beam device of claim 1 wherein the semiconductor slice is a doped semiconductor wafer that has a center and a radially outwardly extending periphery.

4. The electron beam device of claim 3 wherein the doped wafer has a non-uniform distribution of dopant material.

5. The electron beam device of claim 4 wherein the doped wafer has a lesser dopant concentration near the center and increasing amounts of dopant extending radially outwardly.

6. The electron beam device of claim 3 wherein the semiconductor wafer is a germanium wafer.

7. The electron beam device of claim 1 wherein the conductive plate anode is planar.

8. The electron beam device of claim 1 wherein the electron beam extending over the area of the plate has a uniform intensity distribution over the area of the conductive plate anode.

9. The electron beam device of claim 1 wherein a target material for said electron beam is proximate to the anode.

10. The electron beam device of claim 1 wherein said ion plasma is a low temperature plasma.

11. The electron beam device of claim 1 having means for generating a dithering electric field superposed on the electron beam near the conductive plate anode.

12. The electron beam device of claim 1 having means for generating a magnetic field superposed on the electron beam near the conductive plate.

13. A wide area electron beam device comprising,

a chamber having a partially evacuated interior enclosed by walls, including first and second end walls and a side wall structure;

first and second spaced apart wire mesh electrodes defining a spatial volume in relation to the chamber side wall structure;

a neutral ion plasma generated within the spatial volume between the first of the spaced apart wire mesh electrodes and a first end wall of the chamber;

a doped semiconductor slice high voltage cathode between the first and second electrodes configured to allow charged particle permeability therethrough and having a high voltage thereon, drawing ions from the plasma through the first wire mesh electrode and producing secondary electrons traveling toward and traversing the second wire mesh grid by means of a positive voltage thereon;

a conductive plate anode near the second wall of the chamber receiving the secondary electrons traversing the second grid thereby forming an electron beam impinging upon a target placed upon the anode.

14. The electron beam device of claim 13 wherein the doped semiconductor slice cathode has a central region at a first dopant concentration and a radially outward second dopant concentration.

15. The electron beam device of claim 13 wherein the doped semiconductor slice is a semiconductor wafer.

16. The electron beam device of claim 14 wherein the non-uniform distribution of dopant material is circularly symmetric.

17. The electron beam device of claim 15 wherein the semiconductor wafer is a silicon wafer.

18. The electron beam device of claim 13 wherein the conductive plate anode is planar.

19. The electron beam device of claim 13 wherein the electron beam extending over the area of the plate has a uniform intensity distribution over the area of the conductive plate anode.

20. The electron beam device of claim 13 wherein a target material for said electron beam is proximate to the anode.

21. The electron beam device of claim 13 having means for generating a dithering electric field superposed on the electron beam near the conductive plate anode.

22. The electron beam device of claim 13 having means for generating a magnetic field superposed on the electron beam near the conductive plate.